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Research Article

Which questions drive the Mapping and Assessment of Ecosystems and their Services under Action 5 of the EU Biodiversity Strategy?

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Abstract

Action 5 of the European Union's Biodiversity Strategy to 2020 asks that Member States map and assess the state of ecosystems and their services in their national territory. Policymakers and stakeholders of these countries frequently ask why this work is necessary. This article shows that this question can be broken down into a number of specific questions which, in turn, bring specific requests for knowledge and guidance to the surface. This paper develops a typology of questions and identifies the following five categories: knowledge requests, policy support questions, questions on resources and responsibilities, application questions and technical and methodological guidance questions. Next, this typology of questions is framed in an adaptive policy cycle and coupled to a set of available solutions.

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Keywords

Mapping and assessment, Ecosystem services, Policy questions, Societal questions, Business questions, Management, Biodiversity

Introduction

Target 2 of the European Union's (EU) Biodiversity Strategy to 2020 aims to maintain and enhance ecosystem services in Europe. To this end, the European Commission is developing a knowledge base on ecosystems and ecosystem services. Action 5 of the Strategy sets the basis for this knowledge base. It requires that the EU Member States, together with the European Commission, map and assess the state of ecosystems and their services in their national territory by 2014 and to assess the economic value of such services. Member States are also required to promote the integration of these values into accounting and reporting systems at national and EU level by 2020.

To increase the learning opportunity and transfer of knowledge, the Working Group on Mapping and Assessment of Ecosystems and their Services (MAES) was established and is mandated to co-ordinate and oversee Action 5. To date, the working group has developed a conceptual model with an ecosystem typology and proposed indicators and guidance for Member States to map and assess ecosystem condition and ecosystem services. A series of guidance reports is available on the Biodiversity Information System for Europe (BISE*1). The Working Group MAES can be considered as a community of practice. It not only develops guidance but it tests it through case studies, the so-called MAES ecosystem pilots. The pilots are organised according to thematic pools of expertise: forests, agroecosystems, fresh water, marine, urban ecosystems, nature and soil. The pilots follow a common assessment framework (see also Burkhard et al. 2018) which will ultimately need to deliver an EU-wide integrated ecosystem assessment in support of the evaluation of the targets of the EU Biodiversity Strategy and of a post 2020 biodiversity policy framework. Besides developing and testing guidance on mapping and assessment of ecosystems and ecosystem services, the Working Group MAES with support of ESMERALDA, a support and coordination action under the EU's Horizon 2020 framework programme for research and innovation, supports the Member States with the implementation of Action 5 of the Biodiversity Strategy. The level of implementation is high: MAES has started in almost all the EU countries; several countries have finished implementation or are carrying out nationwide projects on MAES (Maes 2016).

Immediately following the start of MAES in 2012, the activities of the working group were guided by a set of policy questions and needs (Maes et al. 2012). This list of questions was formulated by EU biodiversity policymakers (European Commission - Directorate-General Environment) during a two-day workshop as a first basis for discussions with Member States' experts on how to implement Action 5. The questions addressed a range of broad policy needs which can be summarised as follows: Are Europe's ecosystems healthy so that they can continue providing ecosystem services in a sustainable way?

While implementing activities to address Action 5 including feasibility studies, mapping studies, ecosystem assessments and the setting up of national networks or contact groups, different stakeholders, in particular from the public sector but also from business and civil society, have formulated more specific questions in addition to this first list. With the evolvement of the understanding and thinking about the concepts and practical use of ecosystem assessments in policymaking and implementation (e.g. Nahuelhual et al. 2015Rivero and Villasante 2016), the Working Group MAES proposed that the list of initial questions was to be revisited and could evolve over time as priorities may shift depending also on the approaches chosen to map and assess ecosystems and their services. This paper presents an updated list of questions that drive ecosystem assessment activities in the context of the EU Biodiversity Strategy. This update has been carried out in the framework of ESMERALDA.

This paper has three main objectives:

1. Updating the initial list of policy questions provided in Maes et al. 2012 with additional questions;
2. Extending the list with business and societal questions which require spatially-explicit and quantitative information about ecosystems and ecosystem services; and
3. Proposing a typology of policy questions which is framed in a policy cycle and which can be used to link specific questions to specific methods.

Finally, the paper discusses how the typology can be used in initiatives which aim to integrate ecosystems and their services in decision-making and planning.

Methods

This paper addresses three different categories of questions which loosely represent different sectors: policy, business and society. These categories are defined as follows:

- Policy questions are questions which are raised by policymakers at different levels of governance and public decision-making. Typical examples are national or regional ministries or agencies, municipalities or supra-national institutions such as the EU.
- Business questions are formulated by the private sector at different economic scales. Examples include individual farmers, small and medium-sized enterprises, multinationals, but also associations that represent the private sector or their interests.
- Societal questions are raised by individual citizens or organisations that represent civil society such as non-governmental organisations. These types of questions are closely interlinked with policy questions.

Sampling of the questions

Policy questions

Policy questions were gathered through three different mechanisms over a six year period. A first set of broad policy questions was developed during the first MAES stakeholder meeting in December 2012 to which representatives of the European Commission and the Member States were invited. This list of 12 questions is presented in Maes et al. 2012 and in a slightly modified version in the first MAES report (Maes et al. 2013). This list covers issues such as stakeholder involvement, data requirements, current understanding and scenarios.

A second survey of policy questions was organised during the 13th meeting of the MAES working group (16 March 2017, Brussels). This second survey was conducted five years after the first MAES stakeholder meeting and at a point when the majority of member states had started implementing Action 5 (Maes 2016) and had established programmes and activities on MAES. Furthermore, the work being undertaken at EU level to support Member States in addressing Action 5 has increased the need to provide guidance on the assessment of ecosystem condition and ecosystem accounting through an initiative called KIP INCA*2. As a result, more specific policy and technical questions from Member States are being posed. The representatives of the Member States had thus the opportunity to articulate these questions during the 13th MAES working group meeting.

A third sample of questions has been collected during the scientific activities of ESMERALDA. Project members have encoded a series of scientific articles which described case studies on mapping and assessment of ecosystem services (see also Bouwma et al. 2018, Santos-Martín et al. 2018, for a complete description of the database with a collection of case studies). This activity also delivered a number of policy questions.

In total, 82 questions were collected which are included in the supplement of this paper (Suppl. material 1).

Business questions

A non-exhaustive list of 26 business questions has been compiled through two different mechanisms. Firstly, a sample of questions was collected during the scientific activities of ESMERALDA in the same manner as the policy questions (i.e. the encoding of scientific articles). Secondly, the authors scanned the website of the Natural Capital Coalition for questions posed in the consultation round of the harmonised framework that the Natural Capital Coalition had developed. The Natural Capital Protocol is set up for valuing natural capital in business decision-making which will enable better measurement, management, reporting and disclosure of these values*3. The consultation process includes input from leaders of natural capital in business, policy, academia and society on the framework's content. The list of business questions is included in Suppl. material 1.

Societal questions

Societal questions from citizens were extracted from different, ongoing participative projects involving civil organisations and/or citizens. The majority of the questions originate from Ground Truth 2.0*5, a project funded under the Horizon 2020 programme of the European Commission that is setting up and validating six citizen observatories in real life conditions in four European and two African demonstration cases.

In participative workshops, the Citizens Observatory functional design was developed through a story map. A story map (Patton 2017) is a tool used in user-centric software development to help developers envision a planned platform 'through the eyes' of future users and to better understand their needs. The participants of the workshop had to formulate story lines as 'type' of use I want to do 'something' in order to create 'this added value'. Approximately 300 story lines were collected. Many of these story lines were directly or indirectly linked to ecosystem services and the creation of maps through data collection.

Another series of questions was derived from a Flemish project *6 to create a platform with maps of environmental information for citizens. Through surveys, citizens were asked what kind of information they want to see and why. Again, this could be easily linked to maps of ecosystem condition or ecosystem services as this should be the information presented on the platform.

A list with examples of societal questions can be found in the Suppl. material 1.

Analysis of the policy questions

During an ESMERALDA workshop in April 2017, a special session on policy questions was organised. The aim of the session was to determine if the mapping and assessment tools and methods identified during the project could be used to answer the previously posed policy questions (Viinikka et al. 2017). The participants of the session, all partners of the project, were asked to work in pairs with the following instructions:

1. Select a question at random, read it and discuss whether or not social, economic or physical quantification or assessment methods and tools are available to address the selected question in a scientifically robust manner;
2. Next indicate with yes or no if a certain question can be linked to a tool or method to solve the question.

This procedure was repeated until all 82 policy questions were discussed. In a second round, the work of each pair of participants was reviewed by another pair to verify if similar conclusions could be reached. Questions which delivered a common conclusion (i.e. "yes, a method or tool is available to provide scientific support to solve the question") were put aside; while questions which resulted in contrasting views were reviewed in a third round and in a larger group to deliver a final conclusion. In a fourth discussion round, the participants were divided into three groups and were asked to make suggestions for classifying the 82 questions around particular themes.

Results: A typology of questions

The 82 policy questions were each assigned to one of five categories:

1. Knowledge requests,
2. Policy support questions,
3. Questions about resources and the governance of implementation of ecosystem services based approaches,
4. Applications and,
5. Technical and methodological guidance questions (Table 1).

Table 1.

Typology of policy questions which drive the implementation of mapping and assessment of ecosystems and their services.

Category	Description
Knowledge requests	Questions for conceptual clarification and information needs
Policy support questions o Agricultural policy o Biodiversity policy o Climate policy o Disaster risk reduction o Economic policy o Policy impact assessment o Spatial planning	How ecosystem services can be used to support policymaking and implementation
Questions on resources and responsibilities o Costs and resources o Governance	Questions about governance of ecosystem services and resources to implement ecosystem services based projects and programmes
Application questions o Applications of ecosystem services based approach o Payments for ecosystem services o Cost benefit analysis o Communication	How to implement ecosystem services based approaches and how can mapping ecosystem services support real-world applications
Technical and methodological guidance questions o Spatial scale o Scenarios and uncertainty o Priorities and preferences o Other support questions	Questions for giving guidance and specific technical details of mapping ecosystem services (How to map and assess ecosystem services).

The business and societal questions could afterwards be assigned to the same five categories, although most of them fitted the category 'Application questions'.

These five categories are defined as follows:

Knowledge requests: these questions seek conceptual clarification and set out information needs. Typical examples are: "What are ecosystem services?"; "How are ecosystem services linked to biodiversity and ecosystem condition?"; or "What are the current trends of ecosystem services?".

Policy support questions: these questions focus on the use of ecosystem services as a concept to support a particular policy objective. These can include policies which have a positive or a negative impact on ecosystem services or which regulate the use of natural resources including agricultural policy, climate policy, biodiversity policy, spatial planning, impact assessment, disaster risk reduction and economic policy.

Resources and responsibilities: these questions relate to the governance of ecosystem services (Primmer et al. 2015) and ask what can be a possible organisational or institutional structure to implement an ecosystem services based approach. This group also includes questions about human capacity and financial resources which are needed to carry out ecosystem assessments or to ensure that ecosystems and their services are integrated into decision-making.

Application questions: these questions are ‘how to’ questions focusing on implementation of approaches and how to use mapping and assessment outputs to support policy implementation. Examples of such questions are: "How to set up a payments for ecosystem services scheme?"; "How to establish an ecosystem services accounting system?"; "What are the costs and benefits of restoring ecosystems and enhancing services?"; "How to best communicate the importance of ecosystem services?"; "What impact do ecosystems have on my living environment?".

Technical and methodological guidance questions: these questions ask for specific methodological or technical guidance on how to map or assess ecosystem services. Commonly addressed issues are spatial scale, uncertainty, the appropriate use of certain methodologies, priority setting and preferences. Examples are: "How to use data which are collected at spatial scales other than the scale of assessment?"; "How to address conceptual, scientific and data uncertainty?"; "How to set priorities when selecting ecosystem services for assessment/management/including priorities based on preferences of stakeholders?"; and "Which methods are available to map, quantify and assess specific ecosystem services?".

Discussion: A framework for linking questions to solutions

One of the purposes of the EU's initiative on Mapping and Assessment of Ecosystems and their Services (MAES) is to help structure the information it generates in such a way that it is useful to provide answers to questions from different stakeholders. Therefore, the links between questions and solutions to help address and solve these questions need to be made explicit. This is also a key objective of the ESMERALDA project in order to deliver a flexible methodology for supporting MAES.

Questions from policy, business or society related to specific methodologies to map and assess ecosystem services can be addressed in different ways using different tools, models, methods or approaches. Policy, business or societal questions are always dependent on purpose and context (Cowling et al. 2008; Daily et al. 2009). Therefore it is not meaningful to provide detailed, step by step guidance on how questions relating to ecosystem services should be answered. Instead, we present here a broader framework which places the different categories of questions in a policy cycle (Fig. 1) and which links questions to solutions.

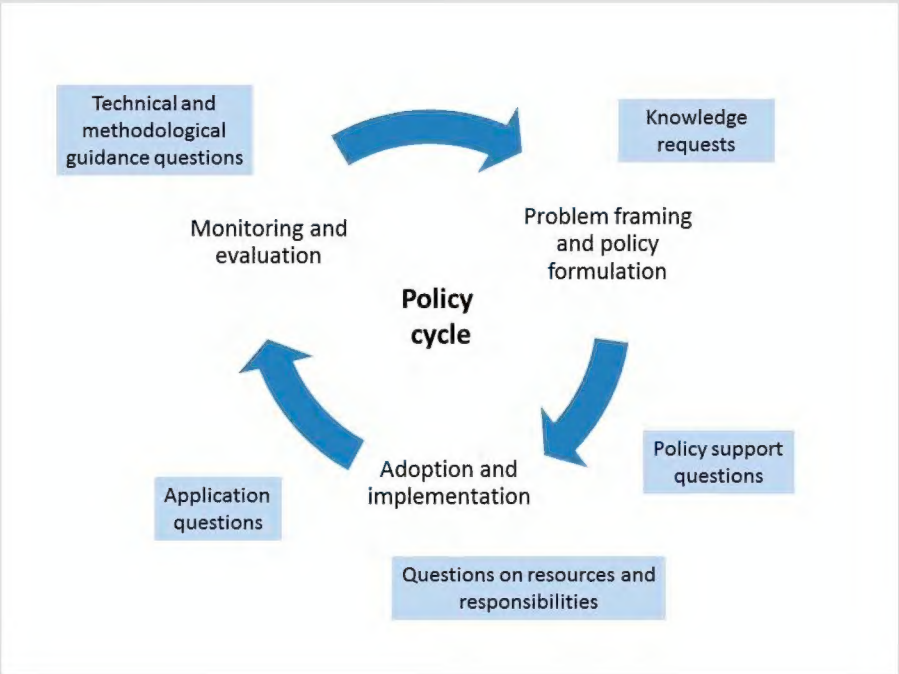

Figure 1.

Placing questions that drive the mapping and assessment of ecosystems and their services in a policy cycle.

An adaptive policy cycle goes through different phases which are in Fig. 1, summarised as problem framing and policy formulation, adoption and implementation and monitoring and evaluation (Adelle et al. 2012; Martinez-Harms et al. 2015). Fig. 1 also includes the typology of questions and shows that the nature of questions evolves with the different phases of the policy cycle. As the decision context changes, policymakers and stakeholders require more detailed and more applied information which is reflected in the questions they pose (see also Gómez-Baggethun and Barton 2013).

Table 2 cross-tabulates the different categories of policy questions with four broad types of solutions. Solutions are understood as the support mechanisms which are available to help solve questions. Here we recognise four different solutions:

1. Tools for raising awareness and enhancing the information and communication about ecosystem services (books, videos, scientific literature of different expertise levels, conceptual models, policy briefs, infographics, websites);
2. Tools for guidance and best practices (manuals, step by step instructions on how to use an ecosystem services approach in a particular context);

Table 2.

A framework for linking questions to four types of solutions.

Type	Communication and awareness raising methods and tools	Guidance documents and best practices (How to do?)	A combination of (scientific) mapping and assessment methods and tools	Case studies
Knowledge requests	×			
Policy support questions		×	×	×
Questions on resources and responsibilities		×		×
Application questions		×	×	×
Technical and methodological guidance questions		×	×	×

3. A combination of different scientific mapping and assessment methods and tools (biophysical, economic and social methods for quantifying ecosystem services)and;
4. Case studies which have used an ecosystem services approach.

Broad knowledge requests are usually part of an initial scoping phase for an assessment or mapping exercise or at the start of a policy process which is interested in taking up an ecosystem services approach. Raising awareness and communication about existing information and sources is a first step. Several examples for awareness-raising are included in resources which provide on-line guidance to ecosystem services based on experiences in research projects (OpenNESS*4 and ValuES*7). Broad knowledge requests need to be translated first into sets of more specific questions in order to find a matching method. A question such as "what is the current trend for ecosystem services" will soon be deconstructed into a set of sub-questions such as: the trend for which ecosystem services, for which area, what values are considered or which socio-economic scenario can be used. Conceptual modelling, for instance in workshops with policymakers and stakeholders, is useful to clarify the links between different components of the social-ecological system.

Policy support questions and also questions on governance and resources often come from sectoral policies such as agriculture or forestry policies (e.g. see Bouwma et al. 2018, Diehl et al. 2016). They can, in principle, be linked to a specific subset of ecosystem services (e.g. food or timber production and the regulating services which directly support provisioning services such as pollination or water regulation). In turn, specific methods are available in case a quantification of services is requested. In addition, specific guidance documents and best practices have been developed to enhance the uptake of ecosystem services in sectoral policies or to assess resources needed to implement an ES approach. Good examples are the guidance on strategic and environmental impact assessment (Geneletti 2016) or guidance on model selection for decision-making (Bullock and Ding 2018). TEEB (The Economics of Ecosystems and Biodiversity) has developed a series of guidance reports based on case studies targeting different policies at different governance

levels*8. However, the private sector, often with support from conservation organisations, has also developed sector specific tools for guidance and best practices. For instance, specific guidance is available to assist businesses assessing their impact on natural resources (Natural Capital Protocol, Natural Capital Coalition 2016; guidance for the oil and gas industry, IPIECA 2011).

Questions relating to the application of an ecosystem services based approach can be linked not only to case studies and specific methods, but also to guidance documents. Again, the TEEB initiative has a collection of case studies which describe examples where a focus on ecosystem services and their economic significance helped decision-makers to find more sustainable solutions for the management of ecosystems*9.

Technical and methodological questions about feasibility, scale, uncertainty, data and quantification lead usually to specific methods or a combination of methods. A useful source for addressing this kind of questions is Burkhard and Maes 2017. This book presents the state-of-the-art of ecosystem services mapping and modelling approaches.

In summary, existing methodologies and guiding potential users who have questions on mapping and assessing ecosystem services is a core task of the ESMERALDA project and will deliver a methods database (Reichel and Klug 2018). In turn, the questions formulated in this paper can also guide the work of ESMERALDA to deliver customised products for policymakers and practitioners.

Conclusions

Six years after the start of the MAES initiative in 2012, people still ask why they need to map and assess ecosystems and their services. The first answer is that high quality and consistent information on the condition of ecosystems and the services and benefits they provide to people are essential to guide priorities and efforts for restoration of degraded ecosystems. Reliable information about ecosystems and ecosystem services is also important for planning and implementation of sectoral policies, in particular if they have a direct impact on natural resources. This article shows that this initial "why MAES" question can be deconstructed into five different types of questions. This typology can be used as a basis for linking policy questions to existing scientific methods and tools to guide planning and implementation processes.

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Conflicts of interest

There are no conflicts of interest.

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Supplementary material

Suppl. material 1: List of policy, business and societal questions doi

Authors: Joachim Maes, Inge Liekens, Claire Brown
Data type: text
Brief description: This supplement contains three tables with policy (Table1), business (Table 2) and societal (Table 3) questions.
Filename: Supplement MAES questions.pdf - Download file (269.72 kb)

Endnotes

*1 https://biodiversity.europa.eu/maes

*2 KIP INCA stands for knowledge innovation project on an integrated system of natural capital and ecosystem services accounting in the EU. More information is available here: http://ec.europa.eu/environment/nature/capital_accounting/index_en.htm

*3 https://naturalcapitalcoalition.org

*4 http://www.guidetoes.eu/

*5 http://gt20.eu/about/about-gt-2-0/

*6 https://www.lne.be/lokale-leefkwaliteit-0 [in Dutch]

*7 http://www.aboutvalues.net/

*8 http://www.teebweb.org/our-publications/

*9 http://www.teebweb.org/resources/case-studies/